

## **REMARKS**

This paper is submitted in reply to the Office Action dated March 22, 2006, within the three-month period for response. Reconsideration and allowance of all pending claims are respectfully requested.

In the subject Office Action, 1-18 were rejected under 35 U.S.C. § 101. Moreover, claims 1, 7 and 15 were rejected under 35 U.S.C. § 112 second paragraph. In addition, claims 1-13 and 15-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Applicants' admitted prior art in Background of Specification (hereinafter Background) further in view of U.S. Patent No. 5,560,007 to Thai, and claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Background and Thai further in view of U.S. Patent No. 6,757,670 to Inohara et al.

Applicants respectfully traverse the Examiner's rejections to the extent that they are maintained. Applicants have amended claims 1, 7, 15 and 19 to clarify the concurrent nature of the use and generation of a bitmap, as will be discussed in greater detail below. Applicants respectfully submit that no new matter is being added by the above amendments, as the amendments are fully supported in the specification, drawings and claims as originally filed.

Turning first to the Examiner's §101 rejections, the Examiner apparently rejects claims 1, 3-6, 7-9, 11-14, 15 and 17-18 for not reciting a tangible result. The Examiner apparently considers the language in claims 2, 10 and 16, relating to avoiding the retrieval of table entries corresponding to inactive values, to suitably recite a tangible result.

Applicants respectfully traverse the Examiner's rejection, however, given that Applicants are aware of no requirement of a tangible result being explicitly recited in a claim. Nonetheless, Applicants note that each of the rejected claims does in fact recite tangible results contrary to the Examiner's assertions. Claim 1, for example, recites executing a query, which is most certainly a tangible result for a database management system. Likewise, claim 7 recites running first and second tasks, which are by necessity computer operations that are more than mere "data manipulation". In addition, claim 15 recites executing a query, similar to claim 1.

The Examiner will also note that claims 1, 7 and 15 have each been amended to additionally recite accessing a bitmap before at least one element in a bitmap is set to an inactive value. As discussed in the application, e.g., at pages 4 and 5, an advantage of the present invention is the ability to enable records to be retrieved and a result set to begin being assembled prior to fully building a bitmap. This represents a substantial performance benefit in many applications, and as such, represents a tangible result of the claimed invention.

Applicants therefore respectfully submit that the claims as they currently read are statutory under 35 U.S.C. § 101. Reconsideration and withdrawal of the Examiner's §101 rejection are therefore respectfully requested.

Next, with respect to the §112, second paragraph rejections, the Examiner apparently considers the terminology "active value" and "inactive value" to be indefinite. However, Applicants have explicitly defined these terms in the specification, in particular, at page 3, line 25 to page 4, line 8. As should be apparent from a reading of Applicants' specification, an "active value" is used to indicate in a bitmap that an associated record satisfies (or potentially satisfies) a selection criteria, while an "inactive value" is used to indicate that an associated record does not satisfy a selection criteria. Furthermore, two different examples of active and inactive values are provided in the referenced passage – one where the active value is "1" and the inactive value is "0", and another where the active value is "0" and the inactive value is "1". Applicants respectfully submit that one of ordinary skill in the art reading this passage would have no difficulty whatsoever in ascertaining the meaning of the terms "active value" and "inactive value". Accordingly, Applicants respectfully request the Examiner's reconsideration and withdrawal of the §112 rejection.

Now turning to the art-based rejections, and in particular to the rejection of independent claim 1, this claim generally recites a method for reducing input/output activity when running a database query. The method as originally claimed includes executing the query on a plurality of table entries in a table using a bitmap having a respective element associated with each table entry, and concurrently with executing the query, generating the bitmap by initially setting a plurality of elements to an active value

and selectably setting respective elements that are associated with entries that do not satisfy a portion of the query to an inactive value.

As discussed, for example, at pages 4 and 5 of the Application, Applicants' invention addresses the problem associated with conventional bitmaps, whereby during execution of a query, records cannot be retrieved, and results from a result set cannot be returned, until a bitmap is completely built. This "start-up delay" associated with conventional bitmaps can substantially delay feedback to a user when a user submits a query, and it can often lead to a perception that the query is slow or may have crashed. Claim 1, as well as the other independent claims at issue, all recite to varying extents the concept of generating a bitmap while executing the query that uses the bitmap. Claim 1, in particular, recites "executing the query...using a bitmap" and "concurrently with executing the query, generating the bitmap". As such the various embodiments of the invention permit a bitmap to be used by a query prior to the bitmap being fully constructed.

To enable the concurrent performance of these tasks, claim 1 recites that the bitmap is generated by "initially setting a plurality of elements to an active value and selectably setting respective elements that are associated with entries that do not satisfy a portion of the query to an inactive value". As such, upon initialization of the bitmap, every table entry is initially considered to potentially be capable of satisfying a portion of a query. It is only after individual elements are set to inactive values while the query is executing that certain table entries are deactivated from further consideration in the query.

To clarify the concurrent nature of the query execution and bitmap generating operations, claim 1 has been amended to further recite that "executing the query includes accessing the bitmap before at least one element is set to an inactive value during generation of the bitmap to determine whether to retrieve a table entry among the plurality of table entries". Support for this amendment may be found, for example, in Fig. 3, as well as on pages 12-14 of the Application as filed. In addition, the processing of an exemplary query, as disclosed at pages 14-17 of the Application as filed, illustrates a specific example where a bitmap is accessed prior to at least one element being set to an inactive value.

The additional language added to claim 1 therefore clarifies the concept whereby a query may utilize a bitmap prior to the bitmap being fully built. Of note, the additional language does not require that the bitmap be accessed prior to any element being set to an inactive value, only that at least one element be set to an inactive value after the bitmap has effectively been used in connection with executing the query. Accordingly, claim 1 as amended distinguishes from conventional bitmaps in that a bitmap is used during execution of a query prior to that bitmap being fully built.

In rejecting claim 1, the Examiner relies on Applicants' background disclosure, along with Thai.

In particular, the Examiner asserts that Applicants' background, and in particular, page 3 thereof, discloses executing a query using a bitmap, and in particular, doing so concurrently with generating the bitmap. The Examiner does admit that the background does not explicitly generating a bitmap by initially setting a plurality of elements to an active value and selectably setting respective elements to inactive values. For this, the Examiner relies on Thai, and in particular, columns 9 and 10 thereof.

With respect to Applicants' background, Applicants strongly disagree with the Examiner's characterization of the material disclosed in the background. In particular, the Examiner argues that the background discloses the concept of executing a query concurrently with building a bitmap. However, as should be apparent from pages 3 and 4 of Applicants' specification, Applicants specifically characterize conventional bitmaps as being specifically incapable of executing a query concurrently with building a bitmap. Put another way, Applicants' background characterizes conventional bitmaps as being usable by a query only after the bitmap is completely built (see e.g., page 4, lines 13-16).

Applicants respectfully submit, however, that conventional bitmaps, as described in the background section of the Application, do not have the capability of being used during execution of a query prior to being fully built. Furthermore, conventional bitmaps are only capable of being accessed in connection with executing a query after the bitmap is completely built. Claim 1 as amended now recites that executing the query includes accessing the bitmap before at least one element is set to an inactive value during generation of the bitmap, and that this access is for the purpose of determining whether to

retrieve a table entry among the plurality of table entries. Given that conventional bitmaps are only usable after they are completely built, the background section of the Application does not disclose this feature of claim 1.

In addition, with respect to Thai, the reference does disclose the generation of a bitmap by setting each bit initially to 1, and then setting individual bits to 0 when the associated records are found to not meet a query condition. However, Thai does not disclose that these operations performed during generation of a bitmap can be performed concurrent with the execution of a query, and in particular, concurrent with the use of a bitmap during execution of a query to determine whether to retrieve specific table entries.

As disclosed at columns 9 and 10 of Thai, as well as at column 4, lines 21-32, Thai is capable of building a bitmap using "on-the-fly learning", whereby as records are retrieved and compared against a filter condition, the associated elements in the bitmap are changed to "0" values to eliminate those records from further consideration. However, there is no disclosure in the reference that the Thai bitmaps are ever accessed for the purpose of determining whether to retrieve records for further consideration at any point prior to the bitmap being completely built. Instead, Thai discloses using the constructed bitmap to exclude records at a later point in time from when the bitmap has been fully built.

As neither the background of the Application nor Thai discloses the concept of concurrently accessing a bitmap in connection with executing a query, while at the same time generating the bitmap, and in particular as neither reference discloses accessing a bitmap before at least one element is set to an inactive value during generation of the bitmap, Applicants respectfully submit that claim 1 is non-obvious over the references cited by the Examiner. Moreover, Thai does not appreciate that a bitmap may be used prior to it being fully built, and thus does not suggest reducing the start-up delay associated with conventional bitmaps. Coupling this with the fact that the background of the Application specifically notes this drawback of conventional bitmaps, Applicants respectfully submit that one of ordinary skill in the art would not be motivated to modify conventional bitmaps to incorporate the functionality recited in claim 1. As such, the Examiner has failed to establish a *prime facie* case of obviousness as to claim 1.

Applicants therefore respectfully submit that independent claim 1 is novel and non-obvious over the prior art of record. Reconsideration and allowance of claim 1, as well as of claims 2-6 which depend therefrom, are therefore respectfully requested.

Next turning to the rejection of independent claim 7, this claim generally recites a method for executing a query that evaluates one or more records of a table according to predetermined selection criteria. The method as originally claimed includes initializing a bitmap wherein each element of the bitmap corresponds to a record of the table and each element is initialized to an active value, running a first task that individually retrieves each of the one or more records from storage according to whether the corresponding element of the bitmap has an active value, running, concurrently with the first task, a second task that updates the bitmap by setting to an inactive value the respective element of the bitmap corresponding to any record that does not satisfy at least a portion of the selection criteria, and continuing to run the first task until all records from the table, having a corresponding active-value bitmap element, have been retrieved from storage.

Similar to claim 1, claim 7 has been amended to additionally recite that "the first task accesses the bitmap before at least one element is set to an inactive value by the second task to determine whether to retrieve a record from storage". As such, claim 7 as amended has been clarified to focus on the concurrent nature of the generation of a bitmap and its use in connection with executing a query.

In rejecting claim 7, the Examiner relies on the same references. Moreover, the Examiner relies on page 4 of the background for allegedly disclosing the execution of first and second tasks concurrent with one another. However, there is no such disclosure in the Background regarding two different concurrent tasks performing the functions of executing a query and generating a bitmap.

Applicants strenuously disagree with the Examiner's contention that the Background of the Application discloses first and second tasks running concurrently to perform these different operations.

Thai, in addition, does nothing to address these shortcomings in the Examiner's rejection. Applicants can find no disclosure in Thai directed to generating a bitmap in one task while executing a query and accessing the bitmap in another task. Moreover, as

discussed above in connection with claim 1, Thai does not disclose any functionality enabling a bitmap to be accessed to determine whether to retrieve a record from storage before at least one element of the bitmap is set to an inactive value. It is only after a bitmap has been completely built, and all appropriate elements have been set to inactive values that the bitmap is made accessible to a query in Thai. Accordingly, as with claim 1, Applicants respectfully submit that the Examiner has failed to establish a *prime facie* case of obviousness as to claim 7.

Applicants therefore respectfully submit that independent claim 7 is novel and non-obvious over the prior art of record. Reconsideration and allowance of claim 7, as well as of claims 8-14 which depend therefrom, are therefore respectfully requested.

Next turning to the rejection of independent claim 15, this claim as originally stated generally recites a computer-readable medium bearing instructions for reducing input/output activity while executing a query, said instructions being arranged, upon execution thereof, to cause one or more processors to perform the steps of executing the query on a plurality of table entries in a table using a bitmap having a respective element associated with each table entry, and concurrently with executing the query, generating the bitmap by initially setting a plurality of elements to an active value, and selectably setting respective elements that are associated with entries that do not satisfy a portion of the query to an inactive value.

Claim 15 has been amended in a similar manner to claim 1, and now recites that executing the query includes accessing the bitmap before at least one element is set to an inactive value during generation of the bitmap to determine whether to retrieve a table entry among the plurality of table entries. Applicants therefore respectfully submit that claim 15 is non-obvious over the prior art cited by the Examiner for the same reasons as presented above with respect to claim 1. Reconsideration and allowance of claim 15, as well as claims 16-18 which depend therefrom, are therefore respectfully requested.

Finally, with respect to the rejection of independent claim 19, this claim generally recites an apparatus for executing a query that includes at least one processor, a memory coupled with the at least one processor, and a database engine residing in the memory and executed by the at least one processor. The database engine as originally claimed is

configured to initialize each element of a bitmap, corresponding to a table, to an active value; retrieve records of the table according to the bitmap; and concurrently with retrieving the records, update individual elements of the bitmap according to a portion of the query.

Claim 19 has been amended in a similar manner to the other independent claims, and now additionally recites that the database engine is configured to access the bitmap before at least one individual element of the bitmap has been updated to determine whether to retrieve a record of the table. As discussed above with respect to the aforementioned independent claims, the combination of features recited in claim 19 are not disclosed or suggested by the prior art cited by the Examiner.

Applicants therefore respectfully submit that independent claim 19 is novel and non-obvious over the prior art of record. Reconsideration and allowance of claim 19, as well as claims 20-23 which depend therefrom, are therefore respectfully requested.

In summary, Applicants respectfully submit that all pending claims are novel and non-obvious over the prior art of record. Reconsideration and allowance of all pending claims are therefore respectfully requested. If the Examiner has any questions regarding the foregoing, or which might otherwise further this case onto allowance, the Examiner may contact the undersigned at (513) 241-2324. Moreover, if any other charges or credits are necessary to complete this communication, please apply them to Deposit Account 23-3000.

Respectfully submitted,

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Date

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